

# TREATMENT OF POLYMER POWDERS BY COMBINING AN ATMOSPHERIC PLASMA JET AND A FLUIDIZED BED REACTOR

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Recently additive manufacturing processes such as laser beam melting (LBM) of polymers have gained more importance for industrial applications (1). Tailor-made modification of polymers is essential to make these processes more efficient and to cover a wider range of industrial applications. The so far used polymer materials show weak performance regarding the mechanical stability of processed parts being mainly due to poor linkage between LBM powder particles. To overcome this, a new route to functionalize the surface of commercially available polymer particles using an atmospheric plasma jet has been investigated. The process of plasma-functionalization using different gas mixtures allows introducing reactive groups onto the particle surface. Consequently, an improvement of adhesion and wettability of the polymer surface (2), (3) without restraining the bulk properties of the powder is achieved. The experiments are conducted in a fluidized bed reactor (FBR) with a diameter of 0.1 m while the plasma jet is located in the center of the distribution plate at the bottom of the FBR. Since fluidized bed reactors are characterized by excellent heat and mass transfer, a homogenous distribution of generated process heat and the induced reactive species can be achieved. The main influencing parameter is the behavior of the dense plasma jet within the fluidized particles. The resulting contact time of single particles with reactive species formed is a key parameter for the functionalization process. Results for the spread of the jet as well as the effect of the functionalization as a function of treatment time will be shown.

## REFERENCES

1. R. D. Goodridge, C. J. Tuck, and R. J. M. Hague, "Laser sintering of polyamides and other polymers," *Prog. Mater. Sci.*, vol. 57, no. 2, pp. 229–267, May 2011.
2. U. Lommatzsch, D. Pasedag, A. Baalman, G. Ellinghorst, and H.-E. Wagner, "Atmospheric Pressure Plasma Jet Treatment of Polyethylene Surfaces for Adhesion Improvement," *Plasma Process. Polym.*, vol. 4, no. S1, pp. S1041–S1045, 2007.
3. C. Arpagaus, A. Rossi, and R. von Rohr, "Short-time plasma surface modification of HDPE powder in a Plasma Downer Reactor – process, wettability improvement and ageing effects," *Appl. Surf. Sci.*, vol. 252, no. 5, pp. 1581–1595, Dec. 2005.

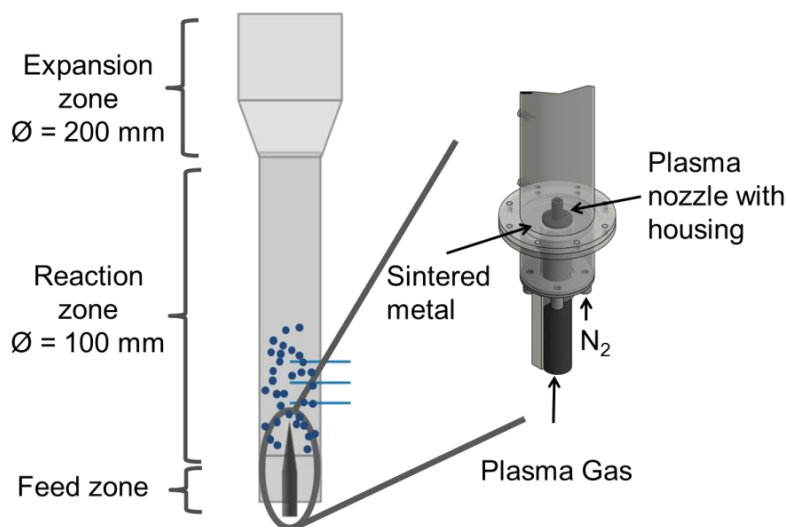


Figure 1: Used fluidized bed reactor with equipped plasma jet